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Molecular Studies of Interfacial Plutonium-Mineral Interactions on Manganese Oxide Hydroxide Mineral Surfaces

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Certain minerals in the environment can sorb metals, including transuranic radionuclides (TRU) such as plutonium. Recent studies indicate that manganese oxide minerals can preferentially sequester TRU over other minerals present in larger quantities. This has implications for the transport of TRU through the environment. The interaction of aqueous plutonium species with manganese oxide minerals is currently under investigation. The mineral surfaces are characterized using x-ray diffraction, BET surface area measurements, potentiometric titration, and soft x-ray absorption fine structure spectroscopy (XAFS) at the manganese L_3 and oxygen K edges. These minerals show a strong tendency for sorbing plutonium ions, and the amount of plutonium sorbed increases with higher pH and lower plutonium concentration. Redox reactions between the minerals and the plutonium are studied using absorption spectroscopy and XAFS. XAFS is also used to determine the structures of the metal/mineral complexes. Ultimately, this data will be incorporated into models that will be used to predict the migration of TRU through the environment.